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ABSTRACT

Designed for Ohio educators responsible for planning programs to prepare high school students for careers in construction, this document presents an overview of Ohio's Integrated Technical and Academic Competencies (ITAC) system of career-focused education and specific information about the construction subcluster of the industrial and engineering systems ITAC career cluster. The first half of the document, which introduces the ITAC system's underlying principles and elements, contains the following items: (1) descriptions of the three types of integrated competencies (core, career cluster, and specialization) forming the ITAC model; (2) guidelines for using ITAC; (3) an explanation of the components of the 51 core ITAC; and (4) a table detailing the academic connections in the core ITAC. The second half of the document, which focuses on the construction subcluster ITAC, is divided into six sections, each of which focuses on one of the following strands deemed essential for all careers: solving problems and thinking skillfully; communicating effectively; applying technology; working responsibly; planning and managing a career; and managing resources. Each section contains the following items: expectation; competencies; sample scenario; sample guiding questions; connections to core

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ITAC competencies; connections to academic models; and connections to Ohio's proficiency tests and ACT Work Keys. (MN)

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Industrial & Engineering Systems Career Cluster

ITAC

for Career-Focused Education

Construction Sub-Cluster

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ITAC

Integrated Technical & Academic Competencies

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Industrial & Engineering Systems Career Cluster ITAC

Construction Sub-Cluster

The Industrial & Engineering Systems Career Cluster includes the entry-level, technical and professional career options within industrial and engineering related fields. This career cluster is divided into three sub-clusters: manufacturing, construction, and transportation. Each of these industries offer many career options depending upon the level of education and training one desires. The *construction sub-cluster* includes all of the building trades (carpentry, electrical, heating, ventilation and air conditioning, plumbing, etc), as well as, engineering, architecture, and surveying. Career opportunities in this industry may be obtained through a variety of educational pathways such as career-technical education, apprenticeships, on-the-job training, community colleges, or universities.

Sample career options within the construction sub-cluster include—

- drafter
- civil engineer
- general contractor
- architect
- mason
- HVAC technician
- wholesaler/retailer
- finish carpenter
- residential electrician
- surveyor
- construction superintendent
- plumber
- crew leader
- heavy equipment operator

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Career-Focused Education

Career-Focused Education combines high-level academics and technical skills with a real-life context for learning that maximizes students' present and future academic and career success. Career-focused education strengthens—

- proficiency test success
- integrated instruction
- partnerships between education and business & industry
- aquisition of transferable career skills

ITAC

Integrated Technical & Academic Competencies for Career-Focused Education

Ohio Department of Education
Division of Career-Technical and Adult Education

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Components of the ITAC System

Integrated Technical and Academic Competencies (ITAC) documents consist of competencies that integrate academic, technical, and employability knowledge, skills, and attitudes. ITACs are presented in resource documents that include the expectations, competencies, scenarios, and academic connections. ITACs are developed through—

- review and synthesis of national academic, employability, and occupational standards;
- review by teachers—both vocational and academic;
- validation by business and industry representatives; and
- direct links to Ohio's competency-based education (CBE) models, proficiency test learning outcomes, and ACT Work Keys® System.

ITAC Model

Three types of ITACs form this model:

Core ITAC – Consists of 51 competencies organized into six strands essential for all careers and sample work-related scenarios. Core ITAC represents what individuals need to know and be able to do to be successful in further education, in a career, and in life.

Career Cluster ITAC – Consists of the foundational competencies common to related occupations or industries and sample work-related scenarios. The six Career Cluster ITACs provide a broad foundation for entry-level, technical, and professional careers.

Specialization ITAC – Consists of competencies and sample scenarios critical to success in a specific industry or occupation within a career cluster. Currently, 55 Occupational Competency Analysis Profiles (OCAPs) represent the Specialization Competencies. As OCAPs are revised, they will become Specialization ITACs.

The ITAC system builds on and expands the Occupational Competency Analysis Profile (OCAP) system, which was designed primarily for occupation-specific vocational programs. The ITAC system provides a broader range of competencies, integrates academic knowledge and skills with technical content, and provides sample scenarios to illustrate work-related context. This system is a resource for ***both*** academic and technical teachers as they plan programs and instruction.

How to Use ITACs

Integrated Technical and Academic Competencies (ITAC) documents are resources for planning programs. The competencies of the ITAC system integrate technical and academic content and are organized into three types, moving from broad to specific—core, career cluster, and specialization. The types are interrelated building blocks for program design. *Core* provides the broad competencies. *Career Cluster* incorporates use of *Core* competencies. *Specialization* incorporates application of both the related *Career Cluster* and *Core* competencies. These ITAC types can be integrated into the overall educational system as follows:

- The Core ITAC could be used to design learning experiences for all students.
- The Career Cluster ITACs—in combination with Core ITAC—could be used to guide courses or experiences in which students explore and develop essential competencies within one of the following career clusters:

  ✔ **Arts & Communication**

  ✔ **Business & Management**

  ✔ **Environmental & Agricultural Systems**

  ✔ **Health Services**

  ✔ **Human Resources/Services**

  ✔ **Industrial & Engineering Systems**

- Specialization ITACs—in combination with Core ITAC and Cluster ITACs—could be used for those programs, courses, and experiences with specific technical skill development.

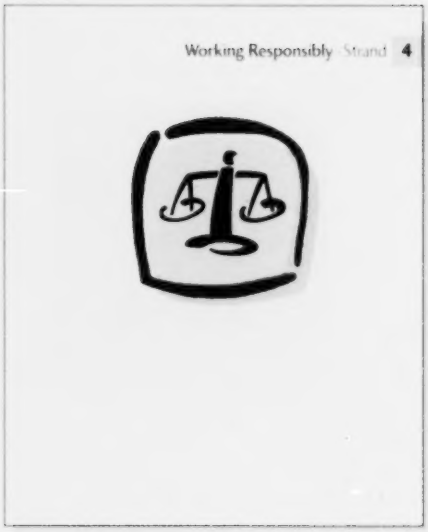
As a curricular and instructional planning tool, ITACs identify the knowledge, skills, and attitudes needed to help students prepare for academic and career success. ITAC documents foster the development of interdisciplinary projects and learning experiences by illustrating the relationships between broad-based career skills and academic content. Educators can use the components of the ITACs in a number of ways for classroom instruction:

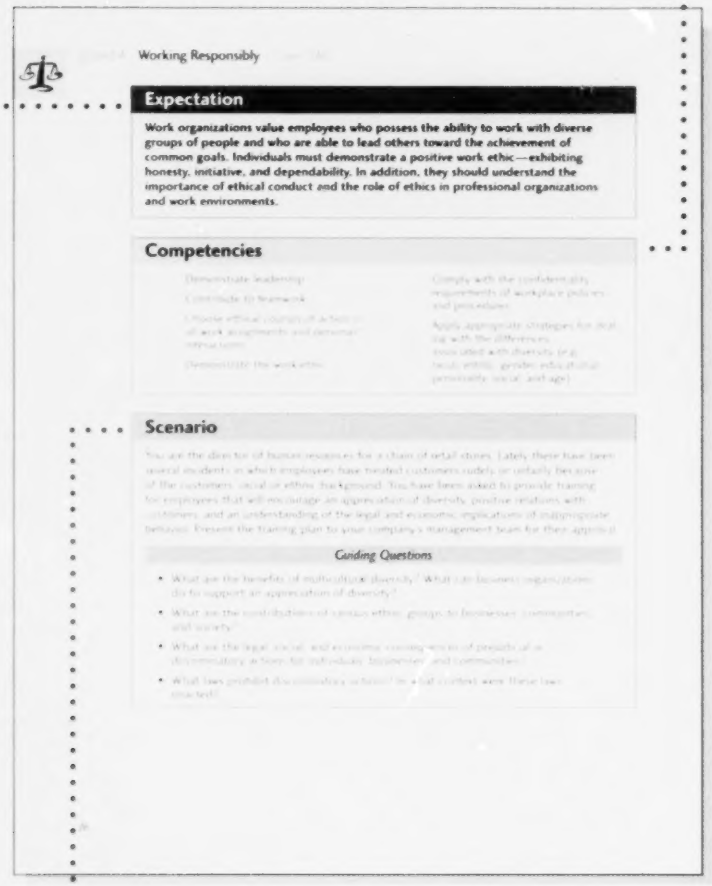
- Competencies can be reviewed and relevant competencies selected for instruction.
- Connections that need to be made between competencies and academic skills can be identified.
- Scenarios can be used as a basis for learning experiences.

Components of Core ITAC

Expectation – a statement of desired workplace behaviors and their importance in the world of work.

Competencies – observable and measurable knowledge, skills, and attitudes essential to achievement of the expectation.




Working Responsibly
Expectation
Work organizations value employees who possess the ability to work with diverse groups of people and who are able to lead others toward the achievement of common goals. Individuals must demonstrate a positive work ethic—exhibiting honesty, initiative, and dependability. In addition, they should understand the importance of ethical conduct and the role of ethics in professional organizations and work environments.
Competencies
Scenario
Guiding Questions

Each strand in Core ITAC has an introduction page which identifies the strand (in words and by icon).

Sample Scenario – a real-life workplace situation requiring learners to apply the knowledge and skills reflected in the strand competencies.

Sample Guiding Questions – targeted questions to use in focusing learners' attention on knowledge and skills covered in the scenario.

Solving Problems and Thinking Skillfully

Communicating Effectively

Applying Technology

Working Responsibly

Planning and Managing a Career

Managing Resources

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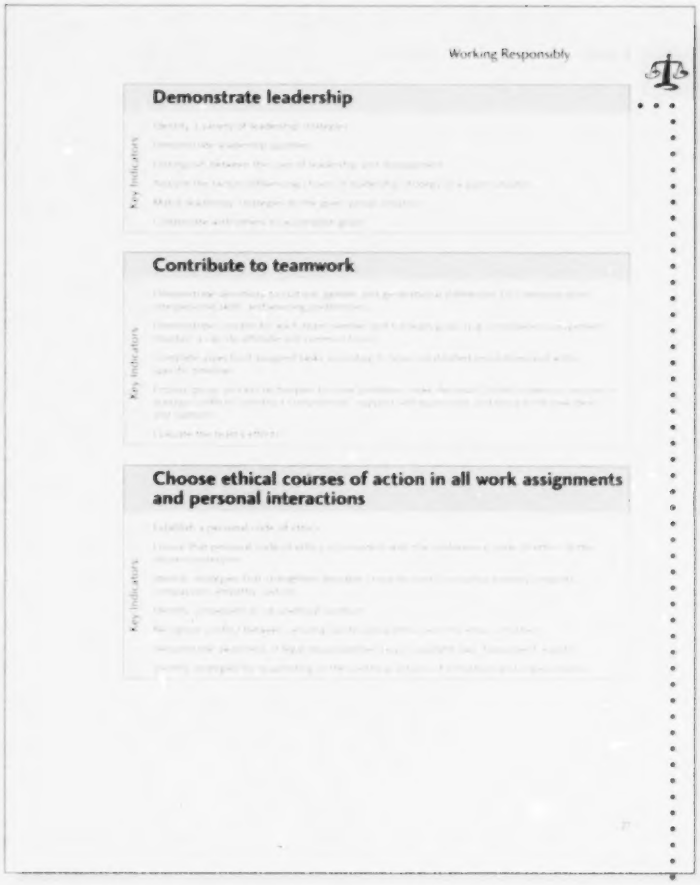
Core ITAC
Competencies
Academic Models
Percent of Model Relating to Core ITAC
Strand 3 — Applying Technology
Strand 4 — Working Responsibly
Strand 5 — Planning and Managing a Career

Connections to Academic Models – the percentage of objectives from Ohio's Competency-Based Education Models, grades PreK – 12, that relate to and/or reinforce the competencies in the given strand. Each academic area is represented by an icon.



Pages following the overview list each competency with its key indicators. Key indicators describe significant elements of competency performance.

The Arts

Mathematics

Social Studies

Language Arts

Foreign Language

Science

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Solving Problems and Thinking Skillfully - Strand 1

Core ITAC

Expectation

All individuals, regardless of career choice, must be able to think for themselves; initiate action on their own; and direct, modify, and assess their own work. Employers seek lifelong learners who can locate and use information. The following competencies specify the knowledge, skills, and attitudes needed to develop the capacity to assess problems and situations, anticipate what might happen next, and continuously search for creative solutions.

Competencies

Solve problems and make decisions in work-related situations

Read for information and understanding

Use observation skills to analyze work-related situations

Apply mathematical processes

Apply measurement and spatial skills

Apply statistical analysis skills

Analyze critical data to guide work activities

Utilize scheduling techniques to ensure that jobs are completed by the stated due date

Demonstrate knowledge of the economy and how it functions as a whole

Demonstrate knowledge of the economy as a framework within which decisions are made by individuals and groups

Scenario

You are among a team of architects hired to plan the revitalization of a deteriorating historic area in your community. In spite of a rich ethnic history and residents who are committed to seeing the area thrive, the neighborhood is plagued by inadequate housing, abandoned buildings, lack of transportation, crime, and declining businesses. The City Planning Commission is prepared to provide resources to encourage economic development, recreation areas, and better housing. Create a design for the neighborhood and present your plans to the commission for their approval.

Guiding Questions

- What alternative uses should be considered for the land to best meet the needs of the community and its citizens?
- What historic and current economic, social, and environmental factors should be considered in the creation of the plan?
- What data regarding the needs and concerns of citizens and businesses in the community would inform the design of the neighborhood? How should this data be collected, analyzed, and presented?

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Solve problems and make decisions in work-related situations

Key Indicators:

- Identify factors that influence problem solving and decision making
- Analyze the source of the problem or the situation requiring a decision
- Generate possible alternatives
- Analyze possible alternatives
- Match problem-solving and decision-making processes to the situation
- Use creative thinking processes to support solving problems and making decisions
- Justify solution or decision with evidence to support or refute alternatives
- Formulate action plans
- Implement action plans
- Evaluate action taken
- Monitor action plans
- Adjust action plans as needed

Read for information and understanding

Key Indicators:

- Locate needed information in written materials using formatting cues, skimming, and scanning
- Interpret written information, including manuals, graphs, and schedules
- Unlock the meaning of unknown or technical vocabulary using standard strategies (e.g., context clues, prefixes, suffixes)
- Locate key points, main ideas, relevant details, facts, and specifications in written materials
- Judge the accuracy, appropriateness, style, and plausibility of information, proposals, or theories in materials read

Use observation skills to analyze work-related situations

Key Indicators:

- Collect data through sensory perceptions—seeing, hearing, tasting, touching, and smelling
- Identify predictable patterns and relationships in given situations
- Monitor situations for deviations
- Identify patterns and relationships that create doubt, uncertainty, difficulty, or disappointment
- Devise appropriate responses to given situations
- Apply past observations to present work-related situations

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Apply mathematical processes

Key Indicators:

- Solve mathematical problems involving whole numbers and integers
- Solve mathematical problems involving fractions, mixed numbers, decimals, percentages, ratios, and proportions
- Apply systematic counting techniques and algorithmic thinking to represent, analyze, and solve problems
- Use estimates to determine reasonableness of proposed problem solutions
- Use appropriate technology in the solution of math-related problems
- Describe problem situations using numerical, symbolic, and graphical representations
- Apply combinations of algebraic techniques
- Represent problem situations with geometric models (including applying the properties of figures)
- Express mathematical ideas orally and in writing

Apply measurement and spatial skills

Key Indicators:

- Demonstrate knowledge of units of measurement
- Select measurement techniques appropriate for given situation
- Match measurement tools to measurement requirements
- Determine degree of accuracy required for given situation
- Analyze implications of the degree of accuracy of various measurements

Apply statistical analysis skills

Key Indicators:

- Estimate probability using standard techniques and formulas
- Analyze software options available for statistical analysis
- Select software option most appropriate for given situation
- Analyze statistical data using selected software
- Make inferences or predictions based on data analysis
- Represent statistical data using tables, charts, and graphs

Analyze critical data to guide work activities

Key Indicators:

- Identify critical data needed
- Determine the level of detail necessary for various situations according to prescribed procedures (including task analysis; procedural analysis; financial activities; personnel matters; customer contacts; noncompliance and violations; and/or deviations from normal operation of processes, equipment and instrumentation)
- Ensure that documentation is complete and error-free and provides valid and reliable evidence
- Ensure that documentation is in compliance with established procedures
- Analyze documentation to determine appropriate actions for specific situations

Utilize scheduling techniques to ensure that jobs are completed by the stated due date

Key Indicators:

- Develop schedules for equipment maintenance
- Develop schedules for materials production, handling, and distribution
- Develop meeting schedules
- Distribute schedules to all concerned personnel
- Implement schedules as planned
- Make changes in schedules as appropriate

Demonstrate knowledge of the economy and how it functions as a whole

Key Indicators:

- Analyze how individuals and societies make choices to satisfy wants with limited resources
- Analyze how factors of production (including land, labor, capital, and entrepreneurship) are used to produce goods and services
- Analyze how individuals and households exchange their resources for income in order to buy goods and services
- Analyze how individuals and business firms use resources to produce goods and services to generate revenue
- Identify the characteristics of command, market, and traditional economies
- Analyze how all levels of government assess taxes in order to provide services

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Demonstrate knowledge of the economy as a framework within which decisions are made by individuals and groups

Key Indicators:

- Determine opportunity costs and trade-offs
- Identify key individuals and groups that make economic decisions at the local, state, national, and international levels
- Identify the important roles that local, state, national, and international governments play in a global economy
- Characterize how government decisions affect individuals
- Identify how geographic factors affect the political and economic systems of other countries
- Analyze how national and international markets allocate goods and services
- Analyze how resources, goods, and services are exchanged in national and international markets
- Demonstrate knowledge of competition and how it affects national and international markets
- Demonstrate knowledge of supply and demand and how it affects national and international markets

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Communicating Effectively - Strand 2

Core ITAC

Expectation

Effective communication is essential to workplaces, communities, and families. Employees with positive communication skills contribute to organizational productivity, enhance interpersonal relationships with coworkers and clients, and create opportunities for promotion and advancement.

Competencies

- Apply basic communication skills
- Apply oral communication skills
- Apply written communication skills
- Apply technical writing skills
- Apply listening skills
- Apply demonstration/presentation skills
- Apply graphic communication skills
- Apply artistic communication skills
- Convey information through multimedia presentations
- Create graphs and charts
- Build interpersonal relationships

Scenario

The Chamber of Commerce in your city would like to develop materials to attract new businesses to the community. Your public relations firm has been hired to create promotional materials that highlight your community's resources, rich ethnic history, and workforce. Create these materials and present them to a variety of community members, including business and industry representatives, private citizens, and civic leaders.

Guiding Questions

- What communication tools should be used to convey this information to the target audiences?
- How will you use creative or artistic expression to communicate the information to the target audience?
- What historic and current events have contributed to the city's resources, ethnic diversity, and workforce?
- How will you work with community groups and representatives to build support for your promotional materials?

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Apply basic communication skills

Key Indicators:

- Guide communication activities using established rules for grammar, word usage, spelling, and sentence construction
- Select communication style appropriate to audience and situation
- Present messages in a form that assists recipient's understanding (e.g., speak and write clearly and concisely, write legibly)
- Locate needed information using communications reference tools (e.g., dictionary, thesaurus, style manual, word division guide)
- Interpret oral, written, and nonverbal messages
- Follow written and oral instructions
- Clarify messages received (e.g., through paraphrasing, questioning)
- Communicate basic messages in a language other than English

Apply oral communication skills

Key Indicators:

- Apply basic communication skills in communicating orally
- Use nonverbal techniques to reinforce the intended verbal message
- Support oral communication with creative attention-getters, analogies, examples, verbal illustrations, etc.
- Supplement oral communication with other forms of communication (including graphic, written, artistic)
- Demonstrate sensitivity to cultural diversity (e.g., accepted variations in distances between speakers, use of eye contact, meaning of gestures; bias-free language)
- Adjust delivery according to perceived reception

Apply written communication skills

Key Indicators:

- Apply basic communication skills in communicating in written form
- Organize information into the appropriate format in accordance with standard practices (including prewriting, drafting, proofreading, editing/revising, preparing final copy/publishing)
- Incorporate creative and original elements (e.g., unique writing style, content, layout) in the written product
- Supplement written communication with other forms of communication (including graphic, oral, artistic)
- Demonstrate sensitivity to cultural diversity
- Use technology (e.g., spelling checkers) to enhance accuracy

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Apply technical writing skills

Key Indicators:

- Apply basic communication skills
- Consider topic in relation to the audience and purpose
- Determine when graphics, charts, and sketches are needed to support and clarify text
- Present information in a clear and concise manner

Apply listening skills

Key Indicators:

- Identify major points of the message (including key information, directions, specific details)
- Determine real needs or goals by attending to both verbal and nonverbal messages
- Differentiate between facts, opinions, and feelings
- Document message using standard note-taking techniques
- Overcome communication barriers
- Clarify communication by rephrasing statements, asking questions, showing empathy, and interpreting both verbal and nonverbal information

Apply demonstration/presentation skills

Key Indicators:

- Apply basic communication skills in presenting a demonstration/presentation
- Select valid and reliable reference(s)
- Organize content based on purpose and audience
- Determine desirable format
- Incorporate creative and original elements into the demonstration/presentation
- Organize the components necessary to conduct a demonstration/presentation (including resources, equipment, handouts, graphics, advance organizers)
- Incorporate media that support the purpose of the demonstration/presentation (including projection equipment, computer software)
- Present the results of an investigation
- Demonstrate the operation of equipment or facilities and/or given techniques and procedures
- Communicate possible problems, processes, and solutions
- Demonstrate knowledge of the topic(s) to be communicated
- Use self-expression appropriate to the situation (including grooming, adjustment of behavior, expression of feelings and ideas)
- Convey information to audience according to accepted business communication practices
- Adjust communication according to audience feedback

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Apply graphic communication skills

Key Indicators:

- Apply basic communication skills in communicating through graphics
- Ensure that all information is accurate and complete
- Specify graphics needed to support presentations
- Communicate information using graphics in, print, poster, or transparency form
- Communicate information using slides prepared with presentation software
- Incorporate creative and original elements into graphics
- Employ effective design techniques in development of graphics (including space, lines, shading, shaping, symbols)
- Demonstrate sensitivity to cultural diversity

Apply artistic communication skills

Key Indicators:

- Apply basic communication skills in communicating artistically
- Participate in a wide variety of experiences that expose self to an appreciation of the arts disciplines—dance, music, theater, and the visual arts
- Analyze exemplary works through the relationship between artistic practices, products, and perspectives
- Interpret historical and modern artifacts
- Demonstrate artistic and creative techniques of production and performance
- Create an original artifact or performance that demonstrates an understanding of history and culture

Convey information through multimedia presentations

Key Indicators:

- Organize content based on purpose and audience
- Evaluate which set of procedures, tools, or equipment will produce the desired results
- Produce a presentation, including designing, creating, importing data and graphics, editing, formatting, and sequencing
- Operate multimedia equipment
- Apply problem-solving techniques to resolve problems encountered in the process of designing and implementing multimedia presentations

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Create graphs and charts

Key Indicators:

- Access sources of needed information
- Select data for inclusion
- Convert data into chosen graphical format
- Ensure that the results are correctly represented (including font, scale, size)
- Draw conclusions from information presented in graphs and charts

Build interpersonal relationships

Key Indicators:

- Demonstrate knowledge of the components of effective communication
- Relate to people of different ages, abilities, genders, cultures, and behavior styles
- Demonstrate caring, empathy, and appreciation for others
- Communicate personal feelings, needs, and ideas constructively
- Demonstrate effective listening skills
- Manage conflict and stress

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Applying Technology - Strand **3**

Core ITAC

Expectation

Technology influences every work environment. To be effective in today's workplace, individuals must be able to use the tools of technology to improve productivity and efficiency. Employers seek individuals who have developed technological skills and who stay abreast of the continuously changing technological environment.

Competencies

- Demonstrate technological literacy
- Access/transmit information using electronic communication systems
- Demonstrate computer literacy
- Use database software in work-related situations
- Use spreadsheet software in work-related situations
- Use word-processing software in work-related situations

Scenario

You own a company that sells and maintains a wide variety of office equipment and computer systems. A small, family-owned business has asked you to develop a proposal for equipping its organization with the technology necessary to improve its productivity and customer service. Prepare a proposal with your recommendations, and present it to the owners of the business to persuade them to accept your proposal.

Guiding Questions

- How have technological innovations influenced workplace performance?
- What information do you need about this business to determine its technological needs?
- How will you obtain that information?
- What hardware, software, and online services does this business need?
- What communication tools will you need to persuade this business to accept your proposal?

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Demonstrate technological literacy

Key Indicators:

- Demonstrate knowledge of the basic technology systems currently available (e.g., manufacturing technology, organizing and accessing information for technology)
- Analyze the interplay of technology with social issues, gender issues, ethics, law, and government
- Identify the uses of technology in industry, education, the political arena, and day-to-day consumer affairs
- Analyze the benefits and costs of new developments in technology
- Make decisions about the use of technology that improve performance in the workplace, in school, and in the home

Access/transmit information using electronic communication systems

Key Indicators:

- Determine which systems are most appropriate for given situations
- Transmit messages electronically
- Access information electronically (e.g., via information services, CD-ROMs, laser disks, videos, and the Internet)
- Conduct searches electronically
- Participate in electronic discussion groups

Demonstrate computer literacy

Key Indicators:

- Choose the hardware, software, and online services that will produce the desired results
- Comply with ethical standards in the acquisition, organization, analysis, and communication of information
- Keep informed of legal parameters regarding computers
- Provide routine maintenance and repair of computer hardware and software
- Write basic computer programs for given purposes

Use database software in work-related situations

Key Indicators:

- Demonstrate knowledge of the functions and features of database software
- Identify the type of data needed
- Determine the best database to aid in the collection, tabulation, synthesis, and evaluation of the particular data identified
- Locate needed operations information using software documentation or help functions
- Construct database for the specified purpose
- Access needed information from the database
- Select report design for presenting data

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Use spreadsheet software in work-related situations

Key Indicators:

- Demonstrate knowledge of the functions and features of spreadsheet software
- Identify the type of data needed
- Determine the best spreadsheet to aid in the collection, tabulation, synthesis, and evaluation of the identified data
- Locate needed operations information using software documentation or help functions
- Construct spreadsheet for the specified purpose
- Analyze data
- Interpret results

Use word-processing software in work-related situations

Key Indicators:

- Demonstrate knowledge of the functions and features of word-processing software
- Construct word-processed documents for the specified purpose
- Locate needed operations information using software documentation or help functions
- Integrate databases, spreadsheets, graphics, and desktop publishing files into word-processed documents
- Edit documents using available software features and functions

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Working Responsibly - Strand 4

Core ITAC

Expectation

Work organizations value employees who possess the ability to work with diverse groups of people and who are able to lead others toward the achievement of common goals. Individuals must demonstrate a positive work ethic—exhibiting honesty, initiative, and dependability. In addition, they should understand the importance of ethical conduct and the role of ethics in professional organizations and work environments.

Competencies

- Demonstrate leadership
- Contribute to teamwork
- Choose ethical courses of action in all work assignments and personal interactions
- Demonstrate the work ethic
- Comply with the confidentiality requirements of workplace policies and procedures
- Apply appropriate strategies for dealing with the differences associated with diversity (e.g., racial, ethnic, gender, educational, personality, social, and age)

Scenario

You are the director of human resources for a chain of retail stores. Lately there have been several incidents in which employees have treated customers rudely or unfairly because of the customers' racial or ethnic background. You have been asked to provide training for employees that will encourage an appreciation of diversity, positive relations with customers, and an understanding of the legal and economic implications of inappropriate behavior. Present the training plan to your company's management team for their approval.

Guiding Questions

- What are the benefits of multicultural diversity? What can business organizations do to support an appreciation of diversity?
- What are the contributions of various ethnic groups to businesses, communities, and society?
- What are the legal, social, and economic consequences of prejudicial or discriminatory actions for individuals, businesses, and communities?
- What laws prohibit discriminatory actions? In what context were these laws enacted?

Demonstrate leadership

Key Indicators:

- Identify a variety of leadership strategies
- Demonstrate leadership qualities
- Distinguish between the uses of leadership and management
- Analyze the factors influencing choice of leadership strategy in a given situation
- Match leadership strategies to the given group situation
- Collaborate with others to accomplish goals

Contribute to teamwork

Key Indicators:

- Demonstrate sensitivity to cultural, gender, and generational differences (in communication, interpersonal skills, and learning preferences)
- Demonstrate concern for each team member and for team goals (e.g., provide encouragement, maintain a can-do attitude and common focus)
- Complete aspects of assigned tasks according to team-established procedures and within specific timelines
- Employ group process techniques to solve problems, make decisions, build consensus, resolve or manage conflicts, construct compromises, support self-expression, and bring forth new ideas and opinions
- Evaluate the team's efforts

Choose ethical courses of action in all work assignments and personal interactions

Key Indicators:

- Establish a personal code of ethics
- Ensure that personal code of ethics is consistent with the professional code of ethics of the chosen profession
- Identify strategies that strengthen desirable character traits (including honesty, integrity, compassion, empathy, justice)
- Identify consequences of unethical conduct
- Recognize conflict between personal/professional ethics and the ethics of others
- Demonstrate awareness of legal responsibilities (e.g., copyright laws, harassment, equity)
- Identify strategies for responding to the unethical actions of individuals and organizations

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Demonstrate the work ethic

Key Indicators:

- Exhibit desirable personal and professional attitudes and behaviors (including positive view of self and work, awareness of impact on others, responsibility, pride)
- Exhibit desirable personal and professional work habits and behaviors (including punctuality, regular attendance, quality performance, meeting or exceeding of job expectations, self-motivation, honesty)
- Determine own role within the company's mission
- Participate in required and voluntary professional development to benefit employer and self
- Improve performance for the benefit of employer and self
- Display a sense of personal responsibility for the welfare of the company and colleagues (including health, safety, environmental concerns)
- Distinguish between work ethics of various organizations, work groups, and cultures

Comply with the confidentiality requirements of workplace policies and procedures

Key Indicators:

- Identify types of confidential information (including mail and information about personnel, customers, company)
- Maintain records on the distribution of information using established format and procedures
- Provide information only to authorized personnel, whether transmitted physically or via technology
- Inspect returned materials for completeness
- Identify the consequences of a breach of confidentiality

Apply appropriate strategies for dealing with the differences associated with diversity (e.g., racial, ethnic, gender, educational, social and age)

Key Indicators:

- Recognize the differences associated with diversity and the implications of those differences
- Demonstrate effective interpersonal skills in working with others of different backgrounds
- Express feelings, actions, and ideas respectfully
- Identify appropriate strategies and solutions for dealing with cultural conflicts and differences
- Demonstrate respect for diverse international business practices and etiquette

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Planning and Managing a Career - Strand **5**

Core ITAC

Expectation

Since work is a significant part of life, individuals need to be actively engaged in seeking a career that matches their interests, abilities, aptitudes, and skills. Career planning enhances the possibility that one's career path will lead to success and satisfaction in work. Employers seek individuals who know what they want from work and can effectively present their qualifications and skills through the job search process, including job applications and interviews. Throughout one's career, it is also important to seek continuous professional development opportunities.

Competencies

- Identify how personal interests, abilities, and skills relate to choosing a career
- Investigate career options
- Chart career using career-planning skills
- Demonstrate skills needed to enter or reenter the workforce
- Demonstrate job-keeping skills
- Upgrade career skills
- Explore opportunities to create a business

Scenario

You have just been granted an interview for a position in the career area of your choice. Assuming you have completed all education and training necessary for this career, prepare to discuss why you selected the career, your long-range career goals, the skills you will bring to the workplace, and your long-term plan for professional development. Following the interview, obtain feedback about your ability to portray your interest and qualifications.

Guiding Questions

- What should you consider when planning a career?
- What are the implications of selecting a nontraditional career?
- What skills are needed to be successful in this career? How can you obtain those skills?
- Where can you obtain information about various careers and career opportunities?
- What communication skills will you use to convey your interest in and qualifications for this career?

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Identify how personal interests, abilities, and skills relate to choosing a career

Key Indicators:

- Determine own interests and aptitudes
- Relate personal interests to academic and occupational skills
- Identify impact of abilities and skills on career development
- Identify how self-knowledge relates to making career choices

Investigate career options

Key Indicators:

- Identify career options, including self-employment and nontraditional careers
- Identify the range of available career information sources
- Research knowledge, abilities, and skills needed in each occupation using a variety of resources (e.g., handbooks, career materials, labor market information, computerized career-information delivery systems, and role models/mentors)
- Select careers that best match interests and aptitudes
- Analyze the impact of factors such as population, climate, employment trends, and geographic location on occupational choice
- Assess differences in the wages, benefits, annual incomes, cost of living, and job opportunities associated with selected career options
- Identify potential conflicts between interest/aptitudes and career choices
- Identify how career choices influence family, personal life, and lifestyle
- Assess labor market information pertaining to career options
- Explore future trends and occupations in the world of work

Chart career using career-planning skills

Key Indicators:

- Demonstrate use of career information
- Identify elements of career planning
- Summarize the educational requirements of various occupations
- Identify skills that apply to a variety of occupations
- Identify challenges that may interfere with individual career plan (e.g., gender issues, misinformation, expectations of others, and conditions of labor market)
- Identify short-term and long-term goals for achieving career plan
- Develop a career plan
- Showcase interests, aptitudes, and skills utilizing a portfolio
- Annually review/revise the individual career plan

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Demonstrate skills needed to enter or reenter the workforce

Key Indicators:

- Apply knowledge of personal abilities, interests, and skills to the seeking of employment regionally, nationally, and globally
- Develop job-getting tools (including résumés, letters of application, portfolios)
- Demonstrate job-getting skills (including locating acceptable jobs, interviewing, completing a job application, and interpreting an employee contract)
- Demonstrate skill in a second language if required for the position
- Maintain a portfolio demonstrating job competence and containing job-getting tools

Demonstrate job-keeping skills

Key Indicators:

- Demonstrate strong communication skills orally, in writing, or via computer
- Apply basic arithmetic and mathematics skills to job tasks
- Apply thinking skills to job tasks (including creative thinking, decision making, reasoning, problem solving, interpretation of information)
- Apply interpersonal skills in relating to others on the job
- Identify an awareness of employer expectations for the job
- Carryout job tasks in accordance with employer expectations
- Display positive work ethic

Upgrade career skills

Key Indicators:

- Identify personal and workplace changes that require upgrading of own skills
- Modify own career goals based on personal and workplace changes
- Analyze various education/training options for securing needed upgrading
- Identify professional development opportunities
- Participate in professional development activities
- Recognize need for lifelong upgrading of career skills

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Explore opportunities to create businesses

Key Indicators:

- Identify an unmet need or opportunity for provision of a good or service
- Identify potential target markets nationally and/or internationally
- Identify factors that contribute to the success or failure of a business
- Evaluate the costs and benefits of future opportunities (e.g., renovations, improvements, expansions, addition of new products or services, international trade opportunities)
- Evaluate entrepreneurship and intrapreneurship opportunities
- Identify components of a business plan, considering various factors for identified opportunities and marketing strategies (including population, climate, location, supply and demand, competition)

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Managing Resources - Strand 6

Core ITAC

Expectation

In high-performance workplaces, all individuals must effectively manage a variety of resources—personal, financial, and environmental. Individuals' ability to maintain good health, contribute to a safe work environment, and manage time not only enhances personal well-being, but fosters the success of the organization or business as well.

Competencies

Apply self-management processes in the workplace

Use reference materials to obtain information appropriate to a given problem, topic, or situation

Maintain/promote wellness

Determine the impact of government regulations and business/industry procedures on the performance of particular work functions

Implement safety procedures and programs

Support the provision of first aid in accordance with company policy and procedures

Manage work and family responsibilities for the well-being of self and others

Determine resources needed to produce a given product or provide a given service

Ensure the quality of products and services

Utilize an inventory control system to track supplies, materials, and equipment

Make informed financial decisions

Scenario

Your city has just experienced an outbreak of E.coli bacteria, which made a large percentage of the population ill. As a member of the city health department staff, your job is to analyze the potential causes of the outbreak and to educate the citizens and businesses in the community so as to prevent future outbreaks. Develop and present several communication tools, such as a 60-second television advertisement and a brochure, that convey your recommendations to prevent further contamination and illness.

Guiding Questions

- What food-handling and production practices contribute to E.coli contamination?
- What are the consequences of unsafe practices for individuals, businesses, and the community as a whole?
- What government regulations and business/industry policies impact the quality and safety of the foods we eat?
- How can individuals and families maintain good health and prevent E.coli contamination?

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Apply self-management processes in the workplace

Key Indicators:

- Develop a system for organizing work
- Apply time-management skills
- Apply anger-management skills
- Apply stress-management skills
- Arrange work environment based on the principles of ergonomics
- Maintain a work area conducive to productivity (e.g., neat, orderly)
- Manage resources to support achievement of goals

Use reference materials to obtain information appropriate to a given problem, topic, or situation

Key Indicators:

- Obtain needed technological and informational reference materials
- Collect information from selected references
- Evaluate the validity and reliability of the information obtained
- Organize information for use in problem solving, decision making, or communications
- Apply information to workplace situations

Maintain/promote wellness

Key Indicators:

- Recognize positive and negative influences on wellness (including social activities, sports, hobbies, environment, health, emotions, economics)
- Participate in the arts disciplines and/or extracurricular activities (including dance, music, theater, visual arts, sports) that promote wellness and balance within an individual
- Follow wellness principles that result in significant, measurable improvements in own overall health condition and the health condition of peer(s)
- Monitor health and health parameters
- Act on environmental issues that influence wellness

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Determine the impact of government regulations and business/industry procedures on the performance of particular job functions

Key Indicators:

- Identify the purpose of government regulations and their impact on the management of resources
- Differentiate among federal, state, and local regulations and local business and industry procedures
- Identify the various agencies involved in government oversight
- Identify which regulations or guidelines take priority in a given situation
- Locate information about the required process(es) for implementing regulations
- Comply with regulations in the handling of materials, services, resources, and/or work activities (including inspection or self-monitoring)

Implement safety procedures and programs

Key Indicators:

- Identify safety requirements
- Demonstrate knowledge of safety rules and guidelines
- Interpret safety signs and symbols
- Demonstrate desirable safety attitudes and habits
- Use safety equipment in accordance with established procedures
- Document results of safety procedures and programs

Support the provision of first aid in accordance with company policy and procedures

Key Indicators:

- Identify supplies and equipment needed in emergency situations
- Locate supplies and equipment needed in emergency situations
- Follow established procedures for the administration of first aid until official help arrives
- Analyze the impact of stress throughout an emergency situation
- Practice universal precautions during first aid procedures (including those related to blood-borne pathogens, confined spaces, emergency egress, fire safety, hearing conservation)

Manage work and family responsibilities for the well-being of self and others

Key Indicators:

- Explore the meaning of work and the meaning of family
- Analyze how work life is affected by families and how families are affected by work life
- Implement strategies for balancing work and family roles

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Determine resources needed to produce a given product or provide a service

Key Indicators:

- Identify the different types of resources involved in the production of a product or provision of a service (e.g., financial, human, material, equipment)
- Create a management plan for the allocation of financial resources to meet financial goals
- Plan for the appropriate allocation and use of materials and equipment
- Plan for the allocation and use of human resources
- Plan for the allocation and use of information and technology needed to make and support decisions
- Plan for the allocation and use of natural resources
- Plan for the allocation and use of space so as to make the best use of facilities for goal achievement

Ensure the quality of products and services

Key Indicators:

- Identify the importance of individual and organizational productivity in the workplace and how it affects the profitability of the business
- Determine the quality- and quantity-control standards and procedures required to produce a specific product or provide a specific service
- Inspect the production of the product or provision of the service to assure quality levels
- Monitor production of products and provision of services
- Select equipment and raw materials that will support quality in the process of producing a product or providing a service
- Interpret quantitative and qualitative records to identify problems and provide a basis for making decisions about the production of products and provision of services
- Provide appropriate documentation regarding the quality of products and services
- Identify corrective actions needed to improve the quality of products and services
- Create new methods for improving the quality of products and services

Utilize an inventory control system to track supplies, materials, and equipment

Key Indicators:

- Determine the factors, including regulations, that influence the type of control system used
- Develop an inventory system
- Maintain the inventory system
- Report the inventory results

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Make informed financial decisions

Key Indicators:

- Identify the need for personal financial management records
- Create a budget
- Evaluate the effectiveness of the budget
- Demonstrate knowledge of how credit affects personal/family finances
- Identify the steps to follow to avoid credit problems
- Make informed consumer choices in response to personal needs and wants
- Identify the factors that influence consumer decisions (e.g., advertisements, peer groups, price, location)
- Recognize the value of company benefits and the importance of retirement planning
- Identify the costs and benefits for individuals of various types of taxation at the local, state, and federal levels

Academic Connections in Core ITAC

Academic Connections answer the question, "What knowledge and skills from the Ohio Compentency-Based Education (CBE) Models are essential to the achievement of the Core competencies?" The academic content represented in the ITAC includes the subject areas from six models:

The Arts

Mathematics

Social Studies

Language Arts

Foreign Language

Science

These connections were identified by relating the content of the competencies in the Core ITAC strands to essential content from the objectives in the Ohio CBE Models. ITAC key indicators for each competency were used to clarify the nature and specificity of the connection. Subject-matter experts in each academic area verified the connections.

The following chart is a summary of the percentages of connections for each model. For specific connections between the core competencies and objectives in each model, visit the following website: <www.cete.org/products>. This summary does not represent all possible opportunities for interdisciplinary curriculum development. Many other connections could be made during the instructional process through authentic projects or workplace situations that involve related content.

Academic Connections in Core ITAC

The chart below illustrates the relationship between the Core ITAC and the objectives in Ohio's Competency-Based Education (CBE) Models. Each column represents the percent of the total number of CBE objectives, PreK–12 grade, that are related to each core competency.

Core ITAC	Academic Models					
Competencies	**Percent of Model Relating to Core ITAC**					
	The Arts	Math	Social Studies	Language Arts	Foreign Language	Science
Strand 1— Solving Problems and Thinking Skillfully						
1.1 Solve problems and make decisions in work-related situations	52%	16%	4%	24%	0%	54%
1.2 Read for information and understanding	5%	1%	19%	33%	5%	32%
1.3 Use observation skills to analyze work-related situations	27%	5%	1%	42%	2%	39%
1.4 Apply mathematical processes	0%	62%	1%	<1%	4%	24%
1.5 Apply measurement and spatial skills	0%	22%	1%	0%	4%	28%
1.6 Apply statistical analysis skills	<1%	9%	<1%	1%	0%	12%
1.7 Analyze critical data to guide work activities	5%	0%	1%	1%	0%	27%
1.8 Utilize scheduling techniques to ensure that jobs are completed by the stated due date	<1%	0%	0%	3%	0%	1%
1.9 Demonstrate knowledge of the economy and how it functions as a whole	6%	0%	6%	1%	2%	0%
1.10 Demonstrate knowledge of the economy as a framework within which decisions are made by individuals and groups	3%	2%	6%	1%	4%	0%
Strand 2 — Communicating Effectively						
2.1 Apply basic communication skills	79%	3%	1%	67%	50%	20%
2.2 Apply oral communication skills	14%	5%	0%	18%	37%	10%
2.3 Apply written communication skills	5%	2%	0%	29%	13%	9%
2.4 Apply technical writing skills	2%	0%	0%	1%	0%	5%
2.5 Apply listening skills	4%	0%	1%	21%	8%	9%
2.6 Apply demonstration/presentation skills	20%	<1%	0%	6%	7%	4%
2.7 Apply graphic communication skills	12%	9%	2%	4%	5%	5%
2.8 Apply artistic communication skills	96%	<1%	1%	27%	8%	3%
2.9 Convey information through multimedia presentation	13%	0%	0%	2%	1%	4%
2.10 Create graphs and charts	3%	10%	2%	4%	5%	6%
2.11 Build interpersonal relationships	4%	0%	4%	5%	11%	7%

Core ITAC Competencies	Academic Models: Percent of Model Relating to Core ITAC					
	The Arts	Math	Social Studies	Language Arts	Foreign Language	Science
Strand 3 — Applying Technology						
3.1 Demonstrate technological literacy	5%	1%	1%	0%	0%	8%
3.2 Access/transmit information using electronic communication systems	<1%	0%	0%	2%	11%	2%
3.3 Demonstrate computer literacy	4%	2%	0%	4%	3%	4%
3.4 Use database software in work-related situations	0%	0%	0%	<1%	0%	3%
3.5 Use spreadsheet software in work-related situations	0%	<1%	0%	0%	0%	2%
3.6 Use word-processing software in work-related situations	<1%	0%	0%	2%	2%	2%
Strand 4 — Working Responsibly						
4.1 Demonstrate leadership	0%	0%	2%	1%	0%	4%
4.2 Contribute to teamwork	20%	0%	5%	23%	4%	5%
4.3 Choose ethical courses of action in all work assignments and personal interactions	0%	0%	<1%	1%	0%	4%
4.4 Demonstrate the work ethic	<1%	0%	1%	13%	3%	4%
4.5 Comply with the confidentiality requirements of workplace policies and procedures	0%	0%	0%	<1%	0%	1%
4.6 Apply appropriate strategies for dealing with the differences associated with diversity (e.g., racial, ethnic, gender, educational, personality, social, and age)	20%	0%	8%	20%	8%	4%
Strand 5 — Planning and Managing a Career						
5.1 Identify how personal interests, abilities, and skills relate to choosing a career	8%	0%	1%	11%	2%	1%
5.2 Investigate career options	6%	0%	0%	<1%	3%	1%
5.3 Chart career using career-planning skills	2%	0%	0%	<1%	2%	1%
5.4 Demonstrate skills needed to enter or reenter the workforce	4%	0%	<1%	1%	5%	<1%
5.5 Demonstrate job-keeping skills	0%	0%	0%	8%	<1%	0%
5.6 Upgrade career skills	0%	0%	0%	0%	0%	0%
5.7 Explore opportunities to create businesses	2%	0%	3%	0%	1%	0%

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Core ITAC	Academic Models					
Competencies	**Percent of Model Relating to Core ITAC**					
	The Arts	Math	Social Studies	Language Arts	Foreign Language	Science
Strand 6 — Managing Resources						
6.1 Apply self-management processes in the workplace	5%	0%	5%	8%	8%	3%
6.2 Use reference materials to obtain information appropriate to a given problem, topic, or situation	12%	0%	1%	7%	-1%	4%
6.3 Maintain/promote wellness	-1%	0%	0%	8%	1%	1%
6.4 Determine the impact of government regulations and business/industry procedures on the performance of particular work functions	0%	0%	4%	0%	0%	0%
6.5 Implement safety procedures and programs	12%	0%	0%	-1%	0%	3%
6.6 Support the provision of first aid in accordance with company policy and procedures	0%	0%	0%	0%	0%	0%
6.7 Manage work and family responsibilities for the well-being of self and others	0%	0%	0%	-1%	0%	-1%
6.8 Determine resources needed to produce a given product or provide a given service	11%	0%	6%	2%	0%	1%
6.9 Ensure the quality of products and services	22%	0%	0%	8%	0%	-1%
6.10 Utilize an inventory control system to track supplies, materials, and equipment	0%	0%	0%	-1%	0%	-1%
6.11 Make informed financial decisions	0%	0%	2%	-1%	0%	0%

Core ITAC Acknowledgments

The Vocational Instructional Materials Laboratory extends thanks and appreciation to the many representatives of business, industry, labor, and community organizations who contributed their time and expertise to the identification and verification of competencies.

The following panel participants verified the technical and academic competencies in the Core ITAC:

Laura Berk, The Center for Manufacturing Excellence, Toledo, Ohio
Kay Briggs, Coalition of Neighborhoods, Cincinnati, Ohio
Walter R. Cates, Sr., Main Street Business Association, Columbus, Ohio
Cap Clegg, Columbus Financial Concepts, Dublin, Ohio
Randy Deatherage, Agnew Farm Equipment, Youngstown, Ohio
Timothy A. Ely, Beacon Electric, Cincinnati, Ohio
Diane Findley, RN, Paul E. Detty MD Inc., Lancaster, Ohio
Sheila Kane, The Andersons General Store, Columbus, Ohio
Keith Meske, Educable TV 25, Columbus, Ohio
Sandy O'Connor, Clark County Dept. of Human Services, Springfield, Ohio
Joyce E. Odor, Columbus Public Schools, Columbus, Ohio
James H. Orsborn, American Electric Power, Columbus, Ohio
Robert A. Osterling, Hy-Level Industries, Cleveland, Ohio
Charlie Pinter, Kroger, Gahanna, Ohio
Scott J. Wallace, Red Roof Inns, Inc., Hilliard, Ohio
Van S. White, Human Resources Consultant, Cincinnati, Ohio
Morris Williams, Coalition of Neighborhoods, Cincinnati, Ohio

The following educator review panel was responsible for reviewing the integrated technical and academic competencies in the Core ITAC:

Virginia Ballinger, Ohio Department of Education, Columbus, Ohio
Heather Boggs, Ohio Department of Education, Columbus, Ohio
David Cairns, Warren County JVSD, Lebanon, Ohio
Denise P. Clapp, Hilliard Davidson High School, Hilliard, Ohio
Carmen R. Giebelhaus, Ohio Department of Education, Columbus, Ohio
Karen P. Heath, Ohio Department of Education, Columbus, Ohio
Peggy Kasten, Ohio Department of Education, Columbus, Ohio
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Betty Kulich, Fort Hayes Metro Education Center, Columbus, Ohio
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Dr. Joyce Malyn-Smith, Education Development Center, Inc., Newton, Massachusetts.

Industrial & Engineering Systems Career Cluster ITAC

Construction Sub-Cluster

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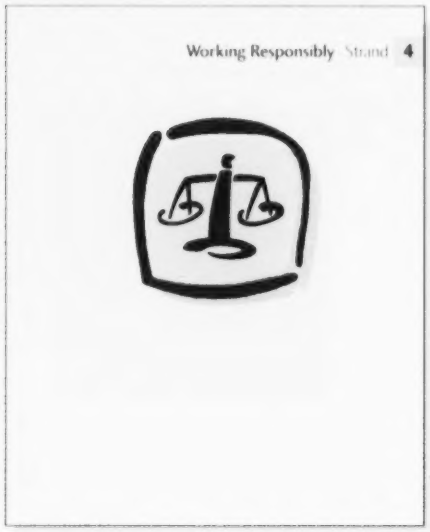
Components of Career Cluster ITACs

Career Clusters:
- Arts & Communications
- Business & Management
- Industrial & Engineering Systems
- Human Resources/Services
- Environmental & Agricultural Systems
- Health Services



Each strand in a Career Cluster ITAC has an introduction page which identifies the strand (in words and by icon) and the career cluster. These pages also appear in the Core ITAC.

Solving Problems and Thinking Skillfully

Communicating Effectively

Applying Technology

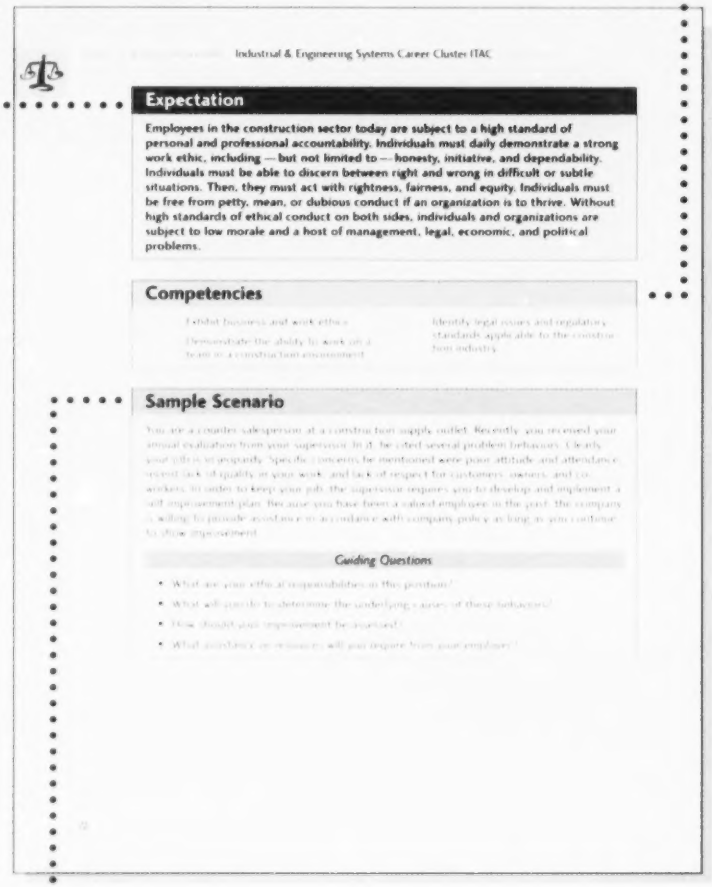
Working Responsibly

Planning and Managing a Career

Managing Resources

Expectation – a statement of desired workplace behaviors and their importance in the world of work.

Competencies – observable and measurable knowledge, skills, and attitudes essential to achievement of the expectation.


Industrial & Engineering Systems Career Cluster ITAC
Expectation
Employees in the construction sector today are subject to a high standard of personal and professional accountability. Individuals must daily demonstrate a strong work ethic, including — but not limited to — honesty, initiative, and dependability. Individuals must be able to discern between right and wrong in difficult or subtle situations. Then, they must act with rightness, fairness, and equity. Individuals must be free from petty, mean, or dubious conduct if an organization is to thrive. Without high standards of ethical conduct on both sides, individuals and organizations are subject to low morale and a host of management, legal, economic, and political problems.
Competencies
Sample Scenario
Guiding Questions

Sample Scenario – a real-life workplace situation requiring learners to apply the knowledge and skills reflected in the strand competencies.

Sample Guiding Questions – targeted questions to use in focusing learners' attention on knowledge and skills covered in the scenario.

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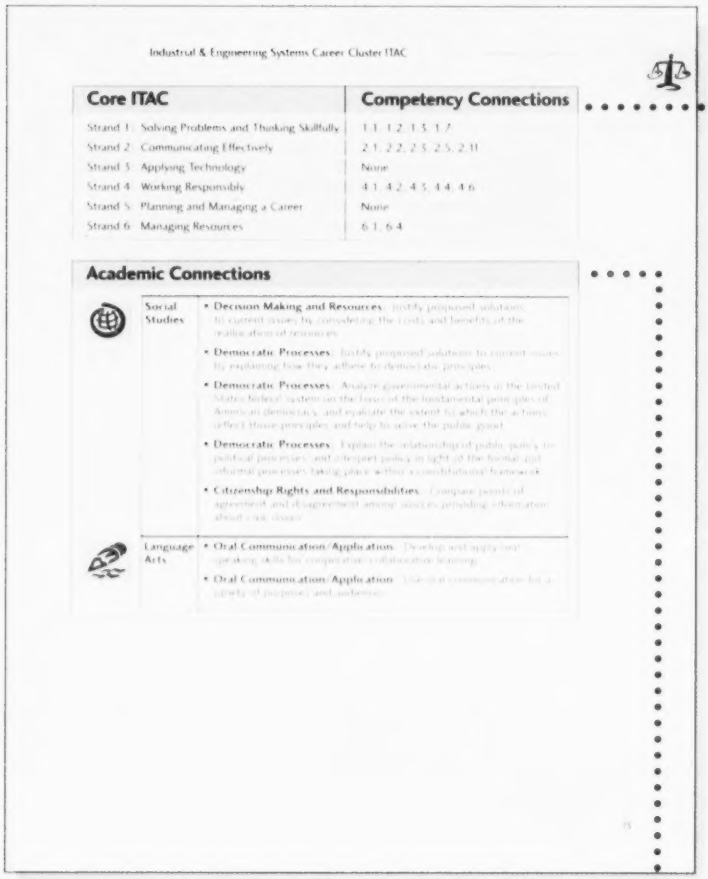
Connections to Core ITAC Competencies – a list, by number, of key competencies in Core ITAC that relate to and/or reinforce the competencies in the given strand and cluster.



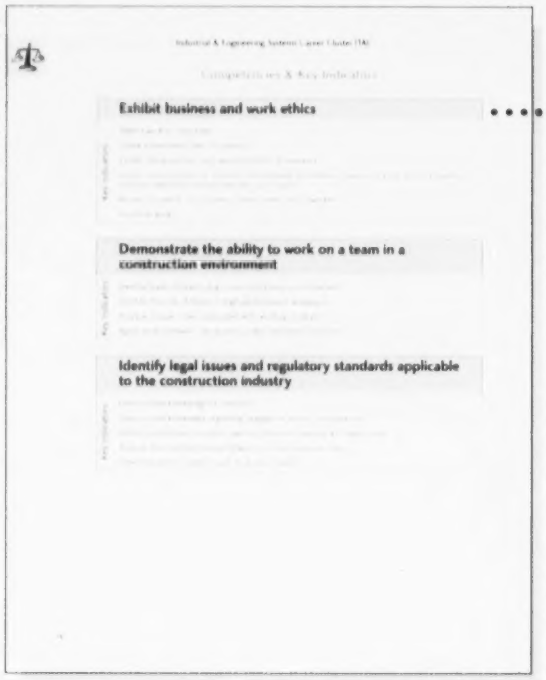
Industrial & Engineering Systems Career Cluster ITAC

Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3, 1.7
Strand 2: Communicating Effectively	2.1, 2.2, 2.3, 2.5, 2.11
Strand 3: Applying Technology	None
Strand 4: Working Responsibly	4.1, 4.2, 4.3, 4.4, 4.6
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.1, 6.4

Academic Connections

Social Studies	• **Decision Making and Resources**: Justify proposed solutions to current issues by considering the costs and benefits of the reallocation of resources. • **Democratic Processes**: Justify proposed solutions to current issues by explaining how they adhere to democratic principles. • **Democratic Processes**: Analyze governmental actions in the United States federal system on the basis of the fundamental principles of American democracy, and evaluate the extent to which the actions reflect those principles and help to serve the public good. • **Democratic Processes**: Explain the relationship of public policy to political processes and interpret policy in light of the social and cultural processes taking place within a constitutional framework. • **Citizenship Rights and Responsibilities**: Compare points of agreement and disagreement among others in providing information about civic issues.
Language Arts	• **Oral Communication/Application**: Develop and apply oral speaking skills for cooperative collaborative learning. • **Oral Communication/Application**: Use oral communication for a variety of purposes and audiences.

Connections to Academic Models – a list of objectives from Ohio's Competency-Based Education Models, grades 9–12, that relate to and/or reinforce the competencies in the given strand and cluster. Each academic area is represented by an icon.



Industrial & Engineering Systems Career Cluster ITAC

Competencies & Key Indicators

Exhibit business and work ethics

Demonstrate the ability to work on a team in a construction environment

Identify legal issues and regulatory standards applicable to the construction industry

Pages following the overview list each competency with its key indicators. Key indicators describe significant elements of competency performance.

Connections to Ohio's Proficiency Tests and ACT Work Keys® – a crosswalk between ITACs (core, cluster, specialization) and assessments that reflect student exit outcomes.

The Arts

Mathematics

Social Studies

Language Arts

Foreign Language

Science

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Solving Problems and Thinking Skillfully - Strand 1

Industrial & Engineering Systems Career Cluster ITAC

Expectation

All individuals, regardless of career choice, must be able to think for themselves; initiate action on their own; and direct, modify, and assess their own work. Employers seek lifelong learners who can locate and use information. The following competencies — focusing on construction processes, applications, trends, and practices — specify the knowledge, skills, and attitudes needed to develop the capacity to assess problems and situations, anticipate what might happen next, and continuously search for creative solutions.

Competencies

- Analyze components of the construction industry
- Analyze trends and issues in the construction industry
- Estimate needed materials and costs
- Demonstrate knowledge of basic wood construction skills
- Demonstrate knowledge of basic electrical and electronics theory
- Verify proper installation of various electrical components and fixtures
- Demonstrate knowledge of refrigeration and heat principles and practices
- Demonstrate knowledge of piping systems
- Demonstrate knowledge of masonry basics

Sample Scenario

As an electrical contractor you have been hired by a homeowner who recently purchased a 1940s home that has had no electrical upgrades. It is a two-story home with three bedrooms and a bath on the second floor; a kitchen with a gas range, a living room, a dining room, and a mud room on first level; and an unfinished basement. The homeowner wants electricity brought up to current NEC and local codes, as well as some specific enhancements (i.e., 3- and 4-way switches, installation of an electric range, low-voltage lighting system, and intercoms). You need to provide, orally and in writing, a cost analysis and the time required to complete the job. Even though there are more effective ways to provide estimates, the homeowner is asking you to be very specific with your quotes.

Guiding Questions

- What specific steps would you take to determine the homeowner's needs and desires regarding the locations of the enhancements and to communicate your cost to the homeowner?
- What factors related to the job should be included in providing the cost estimate?
- What information must be obtained about the layout of the residence?
- How will you find out about the NEC codes and local codes that apply?

Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.4, 1.5
Strand 2: Communicating Effectively	None
Strand 3: Applying Technology	3.1
Strand 4: Working Responsibly	None
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.2, 6.4, 6.8, 6.9, 6.11

Academic Connections

Math	• **Geometry:** Represent problem situations with geometric models, and apply properties of figures • **Geometry:** Deduce properties of figures using transformations and using coordinates • **Algebra:** Describe geometric situations and phenomena using variables, equations, and functions • **Data Analysis and Probability:** Read, in. rpret, and use tables, charts, and graphs to identify patterns, note trends, draw conclusions, and make predictions
Social Studies	• **American Heritage:** Demonstrate historical continuity and/or change with respect to a particular historical development or theme by reconstructing and analyzing the chronological succession and duration of events associated with it • **American Heritage:** Identify significant individuals and groups in history, gauge their impact on specific historical events, and assess how they came to have such influence • **Decision Making and Resources:** Identify the external benefits and costs of economic activities • **Democratic Processes:** Analyze governmental actions in the United States federal system on the basis of the fundamental principles of American democracy, and evaluate the extent to which the actions reflect those principles and help to serve the public good
Language Arts	• **Reading/Meaning Construction:** Confirm and extend meaning in reading by researching new concepts and facts

Academic Connections

Science	• **Scientific Knowledge:** Formulate hypotheses and models that may account for observable events (e.g., electricity and magnetism, gravitation, atoms, bonding, chemical reactions, quantum effects, energy flow in biological systems, predator-prey relationships) • **Scientific Knowledge:** Formulate descriptions of the impacts of various forms of mechanical and electromagnetic waves on various organisms and objects • **Scientific Knowledge:** Formulate explanations and representations of the production, transmission and conservation of energy in biological and physical systems (e.g., weather, volcanism, earthquakes, electricity, magnetism, cellular respiration) • **Scientific Knowledge:** Formulate estimations for the range of energies within and between energy exchange and the interfaces between components within systems

Competencies & Key Indicators

Analyze components of the construction industry

Key Indicators:

- Identify components of the construction industry (e.g., residential, commercial, heavy, highway)
- Demonstrate knowledge of the process of construction, from identifying customer needs to final construction stages
- Identify the interrelationships between the skilled trades, architects/engineers, and materials suppliers
- Investigate historical influences on the construction industry (e.g., urbanization, architectural styles, transportation needs, technological advancements, demographic/population shifts)

Analyze trends and issues in the construction industry

Key Indicators:

- Keep up-to-date regarding technology in tools, equipment, materials, and practices
- Identify environmental issues related to construction
- Identify changes in production methods over time
- Demonstrate knowledge of new and emerging safety procedures
- Analyze how economic trends affect the construction industry
- Analyze how demographic changes have influenced the labor market

Estimate needed materials and costs

Key Indicators:

- Calculate area and volume of given dimensions
- Calculate the amount of material needed for given dimensions
- Calculate time (e.g., charge for labor on a job, project completion, project schedules)
- Determine actual measurements based on a given
- Calculate ratio and proportion of materials
- Solve job-related problems using mathematical handbooks, charts, and tables (e.g., bend pipe, roof pitch)
- Estimate materials needed for a given job
- Estimate the cost of labor and overhead based on given set of contract documents

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Demonstrate knowledge of basic wood construction skills

Key Indicators:

- Identify the structural properties, grades, and types of wood and wood products
- Identify construction features and their relationships to the overall structure
- Identify types of layout instruments/tools and their functions
- Identify types of fasteners used in wood construction
- Select types of fasteners appropriate for a given assembly task

Demonstrate knowledge of basic electrical and electronics theory

Key Indicators:

- Identify how electronics and electricity are used in the construction industry
- Demonstrate knowledge of scientific laws related to electricity
- Demonstrate knowledge of uses of series, parallel, and parallel-series circuits
- Demonstrate knowledge of how to use electrical testing equipment
- Differentiate between AC and DC terms and applications
- Interpret schematic drawings and blueprints
- Demonstrate knowledge of the functions and applications of diodes and transistors
- Demonstrate knowledge of the characteristics and operation of digital and logic circuits
- Demonstrate knowledge of local codes and National Electrical Code (NEC)®
- Identify types and uses of transformers and motors
- Demonstrate knowledge of safety procedures related to working with electricity and electronics

Verify proper installation of various electrical and electronic components and fixtures

Key Indicators:

- Demonstrate knowledge of circuit breakers, fuses, and other over-current devices
- Demonstrate knowledge of conductors and other properties
- Verify the operation of a ground-fault circuit interrupter using a GFCI tester
- Demonstrate knowledge of how to use electrical/electronic testing equipment
- Attach testing equipment
- Comply with safety procedures established for the use of testing equipment
- Make connections in accordance with manufacturer's recommendations
- Select appropriate work surface (e.g., nonmetallic) for performing electrical test
- Maintain dry work area when bench-testing components
- Compare test results with manufacturer's specifications, including polarity
- Determine needed repairs

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Demonstrate knowledge of refrigeration and heat principles and practices

Key Indicators:

- Identify how refrigeration and heat principles relate to the construction industry
- Identify the properties of heat, refrigerants, and mechanical refrigerant cycles
- Demonstrate knowledge of the operation of compressors, condensers, and metering devices
- Demonstrate knowledge of the characteristics and functions of heat systems (e.g., electric resistance, gas-fired, heat pump, oil-fired, and air/water)
- Identify piping, venting, and draining systems appropriate for a given job
- Demonstrate knowledge of local, state, and national codes related to refrigeration/heating systems
- Demonstrate knowledge of safety guidelines and regulations applicable to working with refrigeration/heating systems

Demonstrate knowledge of piping systems in the construction industry

Key Indicators:

- Demonstrate knowledge of the characteristics and functions of potable systems
- Demonstrate knowledge of the characteristics and functions of nonpotable systems
- Identify piping materials
- Demonstrate knowledge of safety procedures applicable to working with piping systems

Demonstrate knowledge of masonry basics in the construction industry

Key Indicators:

- Demonstrate knowledge of masonry materials and construction techniques
- Identify uses of concrete
- Identify alternative components
- Analyze the relationship between the work of masonry and other trades

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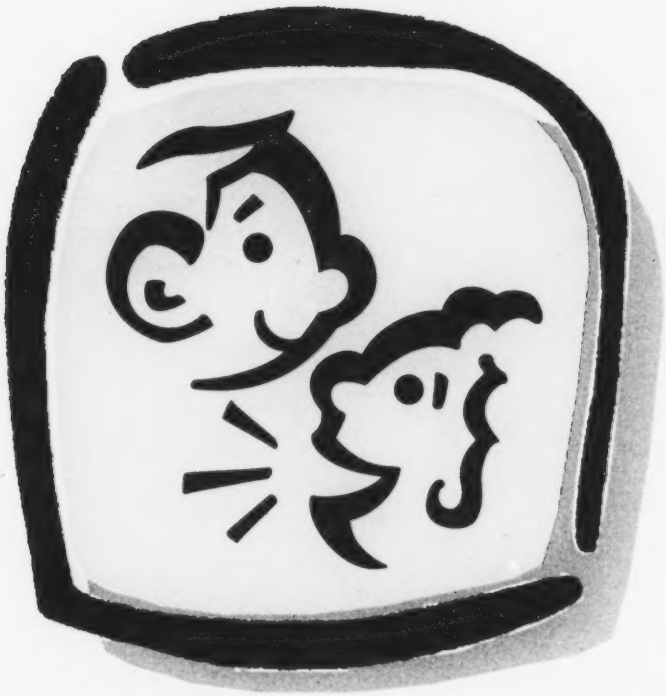
Communicating Effectively - Strand 2

Industrial & Engineering Systems Career Cluster ITAC



Expectation

Effective communication is essential to workplaces, communities, and families. In the construction environment, there exists a specialized system of communications that one must understand to be successful. Employees with strong communication skills contribute to organizational productivity, enhance interpersonal relationships with coworkers and clients, and create opportunities for promotion and advancement.

Competencies

- Build internal and external customer relations
- Communicate using telecommunications tools
- Prepare documentation for work orders
- Interpret blueprints and schematics
- Interpret construction drawings
- Document accidents

Sample Scenario

You are a construction foreman for building a small, out-of-state industrial processing plant in a rural area far from phone services. While work is being done, a second-level wooden beam collapses on a non-English-speaking worker who is using a pneumatic nailer. The worker falls to the first floor and accidently nails his hand to the floor! You must take immediate action based on company regulations, knowing that you will also be required to complete an accident report in a timely manner.

Guiding Questions

- What do you need to know in order to determine what immediate actions are required?
- How will you determine the cause of the accident?
- How will you communicate information about the accident, orally and in writing, to concerned parties?
- How will you supervise differently in the future?
- What modifications to company regulations would you recommend, if any?

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Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.8
Strand 2: Communicating Effectively	2.1, 2.2, 2.3, 2.4, 2.5, 2.10, 2.11
Strand 3: Applying Technology	3.1, 3.2, 3.3, 3.6
Strand 4: Working Responsibly	4.1, 4.2, 4.3, 4.4, 4.5, 4.6
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.1, 6.2, 6.5, 6.6, 6.8, 6.9, 6.11

Academic Connections

Math	• **Geometry:** Deduce properties of figures using transformations and using coordinates • **Algebra:** Describe geometric situations and phenomena using variables, equations, and functions
Language Arts	• **Oral Communication/Structure:** Organize notes and ideas for formal, semiformal, and informal presentations of information • **Oral Communication/Meaning Construction:** Prepare and deliver a formal speech/presentation • **Oral Communication/Meaning Construction:** Assess needs of audience, adjusting language and presentation according to their understanding • **Oral Communication/Meaning Construction:** Communicate orally to inform and persuade • **Oral Communication/Application:** Use oral communication for a variety of purposes and audiences • **Writing/Application:** Vary styles and formats for the intended purpose and audience • **Writing/Application:** Focus writing and tone on such elements as audience, situation, and purpose • **Listening/Visual Literacy/Application:** Use technology and other media as a means of expressing ideas

Competencies & Key Indicators

Build internal and external customer relations

Key Indicators:

- Recognize the importance of all customers to business
- Demonstrate knowledge of the relationship between meeting customer needs and profitability
- Interact with customers and vendors in a professional manner (prompt, friendly, courteous, helpful, knowledgeable, understandable, ethical, accurate)
- Follow through on goals, objectives, and commitments made to customers and vendors (deadlines, delivery specifications)
- Handle customer complaints in accordance with customer service policy
- Deliver formal and informal presentations to customers

Communicate using telecommunications tools

Key Indicators:

- Identify company policies regarding use of telecommunications tools (telephones, answering machine, voice mail, e-mail, teleconferencing systems, pagers, fax, Internet)
- Operate telecommunications equipment in accordance with company policy
- Communicate via telephones, voice mail, e-mail, and teleconferencing and paging systems
- Keep up-to-date concerning new and emerging communication technologies
- Take complete and accurate telephone messages
- Give complete and accurate telephone messages
- Follow established telephone etiquette

Prepare documentation for work orders

Key Indicators:

- Write work orders, including change documents
- Calculate billing
- Confirm parts prices
- Evaluate job costs

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Interpret blueprints and schematics

Key Indicators:

- Identify established procedures for interpreting blueprints and diagrams
- Interpret dimensions, symbols, types of lines, views, and scales
- Determine tolerances associated with dimensions
- Make spatial interpretation of various three-dimensional forms for two-dimensional drawings
- Apply basic algebraic procedures and geometric concepts to blueprint reading
- Work within established industry tolerance parameters as defined by the blueprints

Interpret construction drawings

Key Indicators:

- Identify types of drawings and specifications, including those created electronically
- Identify common scales used in construction drawings
- Identify information about construction features and their relationship using sections and details
- Interpret symbols
- Identify general construction information not clearly indicated by the dimensions using schedules
- Demonstrate knowledge of zoning, building permits, property lines, utilities, building line, setback, building corners, and elevation
- Identify the need for the coordination of all trade documents

Document accidents

Key Indicators:

- Identify the required components of an accident report
- Complete accident reports in accordance with established standards (e.g., completely, legibly, neatly, accurately, in a timely manner)
- File reports with appropriate personnel
- Demonstrate knowledge of the state workers' compensation system

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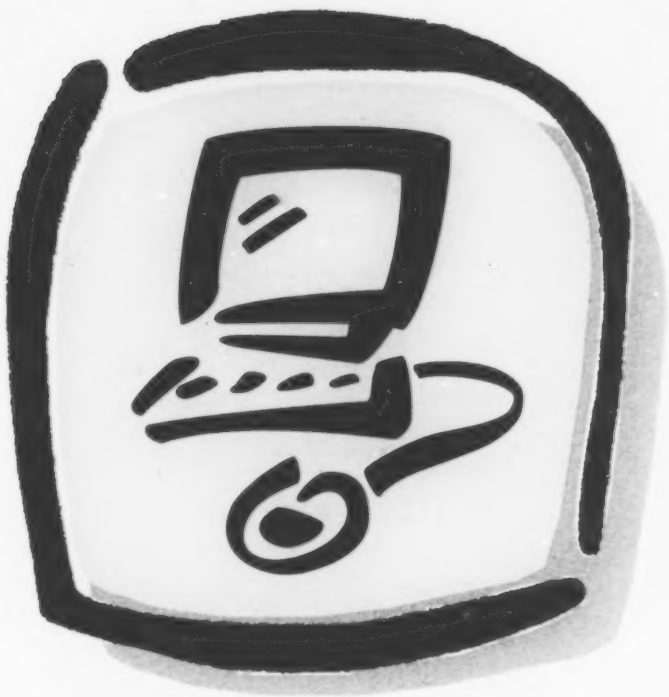
Applying Technology - Strand 3

Industrial & Engineering Systems Career Cluster ITAC



Expectation

Technological advances influence rapid changes in technology and, in turn, to the processes and materials of construction which have a direct impact on and to the skills of those who must understand and work within that setting. To be effective in today's workplace, individuals must be able to function across a range of technology and practice innovative applications of this technology. Employers seek individuals who have developed technological skills and who stay abreast of the continuously changing technological environment.

Competencies

- Analyze the role of technology in construction
- Demonstrate use of basic measuring tools
- Follow established procedures for using common hand tools
- Operate power tools and stationary equipment
- Troubleshoot maintenance problems in accordance with established procedures
- Establish elevation reference points from bench marks and baselines

Sample Scenario

You are a journey person for a large home construction company. For the first time, you and two other carpenters have recently been assigned responsibility for several first-year apprentices who have varying degrees of experience with carpentry tools and equipment. You are in charge of devising and implementing a training plan that includes demonstrations of using measuring tools, power tools, and stationery equipment. You need to present your plan to the apprenticeship committee for approval.

Guiding Questions

- What resources do you have to help you devise the plan?
- How will you determine the exact training needs of the apprentices?
- How will you evaluate implementation of the plan?
- What teaching tools and technologies may be useful for training the apprentices?
- How will you create a team-oriented approach to the training?

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Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3, 1.4, 1.5, 1.7
Strand 2: Communicating Effectively	None
Strand 3: Applying Technology	3.1
Strand 4: Working Responsibly	4.1, 4.3, 4.4
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.1, 6.2, 6.5

Academic Connections

Math	• **Geometry:** Deduce properties of figures using transformations and using coordinates • **Algebra:** Represent inequalities on the number line and in the coordinate plane • **Algebra:** Describe geometric situations and phenomena using variables, equations, and functions

Language Arts	• **Reading/Meaning Construction:** Confirm and extend meaning in reading by researching new concepts and facts • **Reading/Meaning Construction:** Use reading as a possible problem-solving strategy to clarify personal thinking and understanding

Science	• **Scientific Inquiry:** Select, invent, and use tools, including analog and digital instruments, to make and record direct measurements • **Scientific Inquiry:** Explore discrepant events, and develop and test explanations of what was observed • **Conditions for Learning Science:** Access appropriate technology to perform complicated, time-consuming tasks • **Applications for Science Learning:** Analyze the contributions of advances in technology through history to own everyday life • **Application for Science Learning:** Extend the limits of human capabilities using technological enhancements • **Applications for Science Learning:** Promote public awareness of the interaction of technology with social issues

Competencies & Key Indicators

Analyze the role of technology in construction

Key Indicators:

- Demonstrate knowledge of technology trends
- Identify technological advancements and their influence on the construction industry
- Analyze the costs and benefits of technological innovations

Demonstrate use of basic measuring tools

Key Indicators:

- Identify measuring tools and their functions
- Select measuring tools appropriate for given task
- Measure inside/outside diameters, lift, end-play, and backlash
- Interpret charts, graphs, and schematics

Follow established procedures for using common hand tools

Key Indicators:

- Identify construction tools and their uses (impact, cutting, shaping, gripping, holding)
- Select tools appropriate for given task
- Inspect tools before using for specified task
- Follow established safety procedures for given tool
- Perform specified task with given tool
- Maintain tools
- Inventory tools
- Secure tools

Operate power tools and stationary equipment

Key Indicators:

- Identify types of power tools and stationary equipment and their functions
- Select power tool and stationary equipment appropriate for given task
- Inspect power tools and stationary equipment
- Operate power tools and stationary equipment for given task
- Apply established safety procedures
- Maintain power tools and stationary equipment
- Store tools and accessories in designated area

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Troubleshoot maintenance problems in accordance with established procedures

Key Indicators:

- Perform multisensory inspections
- Identify specific problem(s)
- Document maintenance problems
- Obtain all available information about given maintenance problem, including safety procedures (e.g., LOTO, MSDS), using specifications manuals
- Perform operational checks
- Identify possible solutions for identified maintenance problems

Establish elevation reference points from bench marks and baselines

Key Indicators:

- Locate bench marks and/or baselines
- Establish height using a leveling instrument (e.g., laser, transit)
- Set grade stakes

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Working Responsibly - Strand 4

Industrial & Engineering Systems Career Cluster ITAC

Expectation

Employees in the construction sector today are subject to a high standard of personal and professional accountability. Individuals must daily demonstrate a strong work ethic, including — but not limited to — honesty, initiative, and dependability. Individuals must be able to discern between right and wrong in difficult or subtle situations. Then, they must act with rightness, fairness, and equity. Individuals must be free from petty, mean, or dubious conduct if an organization is to thrive. Without high standards of ethical conduct on both sides, individuals and organizations are subject to low morale and a host of management, legal, economic, and political problems.

Competencies

- Exhibit business and work ethics
- Demonstrate the ability to work on a team in a construction environment
- Identify legal issues and regulatory standards applicable to the construction industry

Sample Scenario

You are a counter salesperson at a construction supply outlet. Recently, you received your annual evaluation from your supervisor. In it, he cited several problem behaviors. Clearly, your job is in jeopardy. Specific concerns he mentioned were poor attitude and attendance; recent lack of quality in your work; and lack of respect for customers, owners, and co-workers. In order to keep your job, the supervisor requires you to develop and implement a self-improvement plan. Because you have been a valued employee in the past, the company is willing to provide assistance in accordance with company policy as long as you continue to show improvement.

Guiding Questions

- What are your ethical responsibilities in this position?
- What will you do to determine the underlying causes of these behaviors?
- How should your improvement be assessed?
- What assistance or resources will you require from your employer?

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Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3, 1.7
Strand 2: Communicating Effectively	2.1, 2.2, 2.3, 2.5, 2.11
Strand 3: Applying Technology	None
Strand 4: Working Responsibly	4.1, 4.2, 4.3, 4.4, 4.6
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.1, 6.4

Academic Connections

Social Studies	• **Decision Making and Resources:** Justify proposed solutions to current issues by considering the costs and benefits of the reallocation of resources • **Democratic Processes:** Justify proposed solutions to current issues by explaining how they adhere to democratic principles • **Democratic Processes:** Analyze governmental actions in the United States federal system on the basis of the fundamental principles of American democracy, and evaluate the extent to which the actions reflect those principles and help to serve the public good • **Democratic Processes:** Explain the relationship of public policy to political processes, and interpret policy in light of the formal and informal processes taking place within a constitutional framework • **Citizenship Rights and Responsibilities:** Compare points of agreement and disagreement among sources providing information about civic issues
Language Arts	• **Oral Communication/Application:** Develop and apply oral speaking skills for cooperative/collaborative learning • **Oral Communication/Application:** Use oral communication for a variety of purposes and audiences

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Competencies & Key Indicators

Exhibit business and work ethics

Key Indicators:

- Attend work as scheduled
- Follow established rules of conduct
- Exhibit characteristics and responsibilities of teamwork
- Exhibit characteristics of a productive employee (friendliness, quality of work, honesty, loyalty, initiative, flexibility, positive attitude, punctuality)
- Respect property of customers, other trades, and coworkers
- Prioritize work

Demonstrate the ability to work on a team in a construction environment

Key Indicators:

- Identify types of teams (e.g., cross-functional, cross-trained)
- Identify the role of teams in high-performance workplaces
- Analyze unique issues associated with working on teams
- Apply team problem-solving and conflict-resolution practices

Identify legal issues and regulatory standards applicable to the construction industry

Key Indicators:

- Demonstrate knowledge of contracts
- Demonstrate knowledge regarding negligence and its consequences
- Identify established company/agency policies for dealing with legal issues
- Analyze the interrelationship between local and national codes
- Determine which code(s) apply to given situation

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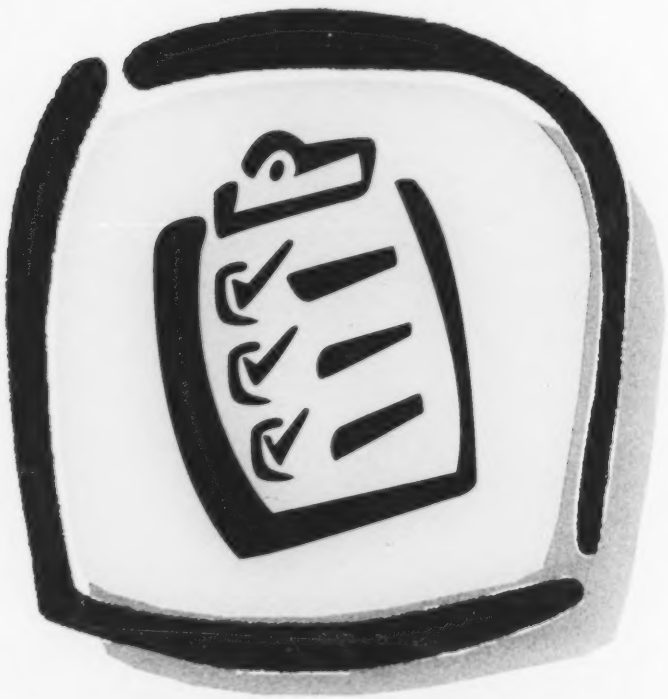
Planning and Managing a Career - Strand 5

Industrial & Engineering Systems Career Cluster ITAC



Expectation

Since the world of construction offers an array of career opportunities, individuals need to be actively engaged in seeking a career that matches their interests, abilities, aptitudes, and skills. Career planning enhances the possibility that one's career path will lead to success and satisfaction in work. Employers seek individuals who know what they want from work and can effectively present their qualifications and skills through the job search process, including job applications and interviews. Throughout one's career, it is also important to seek continuous professional development opportunities.

Competencies

- Explore careers in the construction industry
- Seek employment in the construction industry
- Plan for professional development
- Manage professional career

Sample Scenario

You have been working in construction and are very much interested in advancing your career in the construction industry. Your employer will provide tuition assistance if you establish a plan for your professional development. Explore qualifications for various positions, and develop a plan to obtain your career goals. Include a career ladder, education and training opportunities, and a plan for seeking future positions. Present your plan to a panel of employer representatives.

Guiding Questions

- How will you find out about the variety of careers in the construction industry?
- How will you determine your match (interests, attitudes, and abilities) to a career choice?
- After you identify interest in a specific career, how will you find out about educational requirements and training opportunities?
- How will professional organizations impact your career?

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Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3
Strand 2: Communicating Effectively	2.1, 2.2, 2.3
Strand 3: Applying Technology	3.1, 3.3
Strand 4: Working Responsibly	4.1, 4.6
Strand 5: Planning and Managing a Career	5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7
Strand 6: Managing Resources	6.2

Academic Connections

Language Arts	• **Oral Communication/Structure:** Refine speaking techniques for formal, semiformal, and informal settings • **Oral Communication/Meaning Construction:** Communicate orally to inform and persuade • **Oral Communication/Meaning Construction:** Assess needs of audience, adjusting language and presentation according to their understanding • **Writing/Meaning Construction:** Evaluate, analyze, and synthesize information for writing • **Writing/Application:** Vary styles and formats for the intended purpose and audience • **Writing/Application:** Focus writing and tone on such elements as audience, situation, and purpose
Science	• **Applications for Science Learning:** Refine personal career interests through investigations of the diversity of manufacturing, research, service, and invention processes

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Competencies & Key Indicators

Explore careers in the construction industry

Key Indicators:

- Identify the range of careers in the construction industry
- Explore specific construction interests (e.g., through job shadowing; worksite experience; review of print, audiovisual, and electronic sources; interviews, community service)
- Identify educational requirements for different construction careers
- Identify available programs providing needed education/training
- Research projected growth and availability of various construction careers

Seek employment in the construction industry

Key Indicators:

- Prepare documentation needed for obtaining a position
- Update documents needed for construction employment
- Compile documents in a professional manner
- Identify employment opportunities
- Dress appropriately for job interview
- Present credentials, philosophy, and goals in job interview for a construction position
- Identify the steps to follow in leaving a construction position

Plan for professional development

Key Indicators:

- Identify the role of professional organizations in the professional development process
- Keep up-to-date by reading professional and trade publications, attending conferences, and searching the Internet
- Determine the benefits to business of employees' belonging to professional organizations (membership, networking)
- Examine the benefits of belonging to civic and community organizations
- Determine the areas of continuing education needed in construction
- Examine the benefits of continuing education for the construction industry

Manage professional career

Key Indicators:

- Set personal goals
- Plan for career growth
- Develop skills and characteristics needed to meet professional goals
- Identify possible career paths, including lateral moves, in construction
- Monitor progress toward professional goals

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Managing Resources - Strand 6

Industrial & Engineering Systems Career Cluster ITAC

Expectation

In the modern high-performance workplaces found in the construction industry, all individuals must effectively manage a variety of resources — personal, financial, and environmental. Individuals' ability to maintain a safe working environment ensures the maintenance of good personal health as well as that of coworkers. The employee must also appreciate the importance of prudent inventory control and preventive maintenance measures as ways to increase productivity, which ultimately contributes to the success of the organization.

Competencies

Analyze information from job-related reference materials

Maintain general safety in accordance with government regulations and health standards

Handle hazardous materials in accordance with government regulations and health standards

Handle tools, materials, and equipment in accordance with government regulations and health standards

Comply with company safety procedures

Perform preventive maintenance in accordance with guidelines specified by manufacturer and/or outside authorities with jurisdiction (e.g., government inspectors)

Sample Scenario

You have been hired as an equipment and maintenance scheduler for a medium-sized construction company. When you were hired, the company owners specifically stated that they want you to efficiently maximize utilization of the company's large equipment. In reviewing equipment records, you suspect that preventive maintenance of the equipment is inadequate and may even be creating unsafe conditions. You also realize that some of the equipment you are concerned about is used on a regular basis. In addition, you notice that other equipment the company owns is barely used. You need to develop and implement plans to maximize the company's use of equipment, while maintaining a high-quality and timely preventive maintenance program. Your employer expects you to prepare an oral and written report of the plan.

Guiding Questions

- How will you find out about the preventive maintenance needs of the equipment?
- How will you ensure that employees perform preventive maintenance in accordance with government regulations and health standards?
- What would be the possible consequences of not adhering to manufacturer-recommended maintenance schedules?
- What are the major problems that you must resolve?
- How will you resolve the human conflict between those who need to use and those who need to maintain the equipment?
- How will you assess the maximization of the use of equipment and the cost-effectiveness of implementing the plan?
- What communications tools are needed to implement the plan?

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Core ITAC	Competency Connections
Strand 1: Solving Problems and Thinking Skillfully	1.1, 1.2, 1.3, 1.7
Strand 2: Communicating Effectively	2.1, 2.11
Strand 3: Applying Technology	3.1
Strand 4: Working Responsibly	4.1, 4.3, 4.4
Strand 5: Planning and Managing a Career	None
Strand 6: Managing Resources	6.1, 6.2, 6.3, 6.4, 6.5, 6.6

Academic Connections

Language Arts	• **Reading/Structure:** Apply an expanding vocabulary gained through reading • **Reading/Meaning Construction:** Confirm and extend meaning in reading by researching new concepts and facts • **Reading/Meaning Construction:** Read as a possible problem-solving strategy to clarify personal thinking and understanding • **Reading/Application:** Read selections from a variety of styles and formats, recognizing that style and format influence meaning
Science	• **Scientific Inquiry:** Document potentially hazardous conditions and associated risks in selected homes and public areas

Competencies & Key Indicators

Analyze information from job-related reference materials

Key Indicators:

- Locate needed reference materials
- Select useful support materials and documentation
- Interpret information (e.g., specifications, drawings, contract documents) provided in reference materials

Maintain general safety in accordance with government regulations and health standards

Key Indicators:

- Wear protective clothing appropriate for job (hard hat, hard-toed shoes, buttoned-sleeve shirt, gloves, eye protection, etc.)
- Wear protection devices appropriate for job (dust mask, hearing protection, respirators)
- Check self for potential hazards (secure hair, remove jewelry)
- Practice established lifting techniques
- Maintain personal protective equipment (inspect, clean, repair)
- Follow established procedures for the use of safety apparatus and equipment, including fall protection
- Conduct routine building safety inspections
- Check power sources for potential hazards
- Confirm proper grounding
- Shut down power equipment in dangerous situations using power disconnect switches and established lock-out/tag-out procedures
- Identify the location of emergency flush showers, eye-wash fountains, first-aid stations, fire alarms, and exits
- Maintain work areas in accordance with standards for cleanliness and safety
- Interpret personal safety rights according to shop's Right-to-Know Plan
- Demonstrate knowledge of how to operate fire extinguishers and of classes of fires
- Inspect air makeup and exhaust systems, including intake filters, exhaust filters, fan, and other mechanical components

Handle hazardous materials in accordance with government regulations and health standards

Key Indicators:

- Identify types of hazardous materials
- Interpret container label precautions
- Interpret material safety data sheets (MSDSs)
- Store hazardous materials in accordance with government regulations
- Dispose of hazardous materials in accordance with government regulations

Handle tools, materials, and equipment in accordance with government regulations and health standards

Key Indicators:

- Follow established procedures for the safe use of tools, materials, and equipment, including operation, carrying, lifting, and handling
- Identify potential hazards associated with hand and power tools
- Conduct routine inspections of tools and equipment
- Maintain hand tools, power tools, and equipment

Comply with company safety procedures

Key Indicators:

- Demonstrate knowledge of company safety procedures
- Demonstrate knowledge of company safety plan (e.g., contact person, forms, etc.)
- Identify liability of technician and employer
- Identify basic first-aid procedures
- Identify health and safety hazards
- Follow environmental precautions when discarding parts

Perform preventive maintenance in accordance with guidelines specified by manufacturer and/or outside authorities with jurisdiction (e.g., government inspectors)

Key Indicators:

- Create operating and maintenance records
- Follow preventive maintenance schedule
- Access needed information from past maintenance records
- Access needed information using preventive maintenance manuals
- Log preventive maintenance performed

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Industrial & Engineering Systems Career Cluster ITAC Construction Sub-Cluster Acknowledgments

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The following panel participants verified the technical and academic competencies in the Construction Sub-Cluster ITAC:

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